SRDC Grower Group Innovation
Project final report Beach sand to black clay - Adapting technology and best practice for Homebush farming conditions

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SRDC Grower Group Innovation Project
Final Report

SRDC project number: GGP 020

Project title: Beach Sand to Black Clay

Group name: Homebush Innovative Farmers

Contact person: Tony Bugeja

Due date for report: 01/09/08

Funding Statement:
This project was conducted by Homebush Innovative Farmers in association with the Sugar Research and Development Corporation (SRDC). SRDC invests funds for sugar R&D derived from the sugar industry and the Australian Government.

The Homebush Innovative Farmers is not a partner, joint venturer, employee or agent of SRDC and has no authority to legally bind SRDC, in any publication of substantive details or results of this Project.
Body of Report

Executive Summary:

This project aimed to adapt latest technology & best practice to suit the soil types found in the Homebush/Sunnyside district, and evaluate the cost and benefit of adopting these technologies and practices. To conduct the project the group established partnerships with QDPI, SRDC, IAR Consultants, Mackay Rural Supplies, and BSES.

Issues investigated included; Refinement & assessment of planting systems and planting rates, Cost – Benefit Analysis of the adoption of available technology & best practice, Trialling “pre-plant” fertiliser, and assessment of Soybean varieties.

Key results from the project included: planting rates as low as 3.7T/ha produced similar yields to planting rates of 7T/ha, resulting on cost savings; Pre-planting application of LOS+P in combination with GPS guidance and EM mapping had no detrimental effect on cane & sugar yield, but delivered significant cost savings; Southern bred soybean varieties had some quality advantages, but no yield advantage, and produced less biomass and presented some harvesting issues; the cost/benefit analysis conducted by the group, clearly showed that the technology adoption and practice change paid for itself and delivered a range of benefits.

The project assisted a number of growers to convert over to controlled traffic farming systems, and identified a number of cost saving options. The project also developed the group member’s skills in conducting on farm research, which has the successful application for a 2nd GGIP project investigating the potential of precision agriculture in conjunction with QDPI.

Background:
(Why did you need to do this project?)

Over the past 6 years the Homebush Innovative Farmers have been adopting available technology & best practice to improve their farming operations. This technology & best practice include: GPS guidance, E.C soil mapping, controlled traffic, reduced tillage, commercial break cropping, satellite imagery, and variable rate lime & fertiliser application.

As the group expanded these technologies and practices across their farms, a number of issues arose. The issues related to how best to combine the new farming systems with the new technologies in use and apply them to the environmental conditions experienced in their region. The group engaged with SRDC and conducted the project to help address these issues, and deliver reduced cost of production, increased yields, and improved social & environmental outcomes.

Aims:
(Include the Aim and the expected benefits that were listed in Section 2 of your original Application)

The project aims to adapt latest technology & best practice to suit the soil types found in the Homebush/Sunnyside district, and evaluate the cost and benefit of adopting these technologies and practices. Specifically:

• Refine & assess cane planting systems
• Conduct a Cost/Benefit Analysis on the adoption of available technology & best practice.
• Conduct a “pre-plant” fertiliser trial in conjunction with CSR & IAR.
• Establish and monitor soybean variety trials in conjunction with DPI & F to assess the commercial potential of southern bred varieties
• Increase the grower’s capacity to produce robust and sustainable cane crops.
• Develop the group’s skills & knowledge through participation in the planning, design, establishment and evaluation of the trials & trial results.
Methodology:
(How was the project conducted?)

Key project activities included:

1. **Design and construct “Variable Rate Wide Shute Planter”**. A Poplin billet planter was modified with a 460mm wide shute, GPS guidance, Dickey John controller on billet feed, designed to plant a single row on a 1.8m spacing.

2. **Conduct “variable rate planting trial”**.
The planting rate trial was established at Tony and John Bugeja’s farm on the Homebush/Walkerston Road, 13 kilometers south–west of Mackay City (S 21.22092550°, E140.0910145°) on a soil type classified as a yellow chromosol. The randomised plot trial was planted on the 25 August 2006 following a well grown soybean crop. The soybeans were incorporated by discing, followed by a deep ripping with a final spring-tine/roller combination which completed the land preparation program. The trial consisted of three planting rates, 3.7, 5.5 and 7.0 tonnes of cane per hectare (TCH) respectively with three replications per treatment in a randomised plot layout. Each replication plot comprised of 6 x 1.8 metre beds with the exception of two replicates which had additional rows due to an internal winch tow-path. Soon after establishment, permanent ten linear metre measurement areas (18m²) were marked out in the fourth cane row of each plot, a five metre buffer strip was established between the headland and the start of the measurement plots. A modified Poplin billet planter with a 460mm shute was used to plant the variety Q209 at 1.8 metre row spacing. A Dickey John hydraulic controller was fitted to the billet feed mechanism to ensure a consistent flow of billets when calibrated. The trial was planted with GPS guidance on the 24/08/2006 with Di-ammonium Phosphate at 185 kilograms per hectare (33 kg/ha N and 37 kg/ha P) and side-dressed with Biodunder at 2.5 cubic metres/ha (? kg/ha K). Weeds were controlled with a post ‘hill-up’ application of Stomp Xtra® and Atrazine at 2 litres and 1.5 kg/ha respectively with a final spray of Commanche® at 3 kg/ha the ‘out of hand’ stage.

3. **Conduct “pre-plant fertiliser application trial”**. Location: Rosella, Mackay, Sandiford soil (Class A Sodosol), Fallow plant, Q209, single row 1.8m
The aim of the trial was to To investigate the agronomic suitability of pre-plant applications of LOS+P in sugarcane farming systems.
The trial was established to trial crop performance where the crops’ entire nutrient needs were applied pre-plant.
This was compared to conventional practice of a starter fertiliser application at planting, followed by a topdressing applying the balance of nutrients required.
The block was EM mapped by Tony Crowley (IAR), soil tested according to changes in soil types, and fertilisers were selected according to soil test results.
4. **Conduct “soybean variety trial”**. The trial was established at Tony and John Bugeja’s farm on the Homebush/Walkerston Road, 15 kilometres south–west of Mackay City (21.252610°, 149.081529°) on a soil type classified as a grey sodosol. A ‘green manure’ crop of Leichhardt had been initially planted on the 15 December 2006. On the 15 January 200 the balance of the paddock was planted to the new southern bred varieties, Bunya, DN2-11, ManPKN (commercially released as Fraser in November 2007) and the tropically adapted varieties, Leichhardt and Stuart. There were three replications in a randomised block design. Each plot comprised 6 rows at 0.8 metre rows spacing (Table1). Seedbed preparation involved a discing and deep ripping operation followed by a final pass with a rotary hoe. The trial was planted into a full soil moisture profile. A six row Janke, parallelogram planter was used for establishing the trial. No fertiliser was applied as the paddock had a history of mill mud application. Weeds were controlled by two inter-row cultivations and strategic hand weeding of isolated patches of vine infestations. The planter was calibrated for each variety to achieve an established planting population of 250,000 plants/ha with the calibrations based on germination %, estimated field germination %, number of seeds/kg, and the desired established plant population per hectare. Available planter sprocket configurations determined actual planting rates which differed in some cases to the calculated variety seeding rates (Table 2).

The trial was inspected at 6 days after planting (DAP) with a further inspection at 10 DAP after a heavy rainfall event of 95 millimetres which left the germinated seedlings covered in water for a period of 5 hours. The trial was inspected fortnightly to monitor for ‘leaf chewing’ pests using the standard beat sheet method with most monitoring being undertaken between 7 and 9 a.m. Thereafter the trial was inspected and scouted for pod sucking insects at weekly intervals from the initiation of flowering at 42 DAP until hand harvesting at 123 DAP. At 80 DAP permanent ten linear metre measurement areas were marked out in the third row of each plot, a five metre buffer strip was established between the headland and the start of the measurement plots. A square metre (1.25m x 0.8m) was randomly selected from the measurement areas in each plot and the plants counted. These data were then used to calculate the established plant populations. At 116 DAP the plots were assessed as being generally physiologically mature with most of the pods having yellowed off and with 50% of the pods being brown. At 123 DAP a square metre (1.25m x 0.8) was randomly selected from the permanent measurement areas. The plants within the 1m² area were counted and cut off at ground level with secateurs. Two plants were randomly selected and measured for harvest height suitability. The seeds were shelled from the pod and weighed after being oven dried at 60° centigrade for 24 hours. These data were then used to calculate the yield of each variety replicate. A sub sample of 100 grams was taken from each sample and counted to calculate the number of seeds per kilogram.

5. **Document and compare costs & benefits of new technology and best practice adaption.** This involved the group members sitting down, documenting their costs and benefits and comparing.
Results and Outputs:
What results were produced by the Project? The results should include data collected, articles or reports written, events held and anything else you see as relevant to the industry. Relevant files including photographs should be provided on a CD.

**PLANTING RATE TRIAL**

**STALK COUNTS/M² OVER TIME**

<table>
<thead>
<tr>
<th>Planting rate</th>
<th>Average stalk counts/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>42 DAP</td>
</tr>
<tr>
<td>3.7</td>
<td>4.02</td>
</tr>
<tr>
<td>5.5</td>
<td>5.19</td>
</tr>
<tr>
<td>7.0</td>
<td>17.80</td>
</tr>
</tbody>
</table>
### HAND HARVESTED RESULTS 16th Aug 2008 (357 DAP)

<table>
<thead>
<tr>
<th>Planting rate (T/ha)</th>
<th>Replicate averages</th>
<th>Total biomass (t/ha)</th>
<th>Tops (ton/ha)</th>
<th>TCH</th>
<th>CCS</th>
<th>TSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.7</td>
<td></td>
<td>148.1</td>
<td>26.4</td>
<td>121.7</td>
<td>15.21</td>
<td>18.5</td>
</tr>
<tr>
<td>5.5</td>
<td></td>
<td>146.2</td>
<td>23.1</td>
<td>123.1</td>
<td>15.06</td>
<td>18.5</td>
</tr>
<tr>
<td>7.0</td>
<td></td>
<td>146.3</td>
<td>23.7</td>
<td>122.6</td>
<td>14.93</td>
<td>18.3</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>nsd p=0.9602</td>
<td>nsd p=0.3246</td>
<td>nsd p=0.9619</td>
<td>nsd p=0.6240</td>
<td>nsd p=0.8899</td>
<td></td>
</tr>
</tbody>
</table>

### MACHINE HARVESTED RESULTS 20th Aug 2008 (361 DAP)

<table>
<thead>
<tr>
<th>Planting rate (T/ha)</th>
<th>Replicate averages</th>
<th>TCH</th>
<th>CCS</th>
<th>TSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.7</td>
<td></td>
<td>122.9</td>
<td>14.73</td>
<td>18.1</td>
</tr>
<tr>
<td>5.5</td>
<td></td>
<td>127.1</td>
<td>14.78</td>
<td><strong>18.8</strong></td>
</tr>
<tr>
<td>7.0</td>
<td></td>
<td>125.4</td>
<td>14.53</td>
<td>18.2</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>nsd p=0.3011</td>
<td>nsd p=0.6730</td>
<td><strong>Significant p=0.0424</strong></td>
<td></td>
</tr>
</tbody>
</table>

**PLANTING RATE TRIAL – DISCUSSION**

- More is not necessarily better
- Excessive tillering results in unnecessary use of nutrients and moisture
- Lower planting rates can only be done with good quality billets
- Assessment of viable eyes prior to planting should be undertaken to ensure good strike
- Even feed of billets is required to ensure no gaps
- Trial only conducted on Q209

Economics – the average planting rate for the central district (Proserpine, Mackay, Plane Creek) is 8t/Ha. If all growers reduced their planting rate to 5.5t/Ha, this translates to 55,000 Tonnes of extra cane that could be milled. This equates to $1.65 million worth of cane (at $30/T)

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**PRE-PLANT NUTRIENT APPLICATION TRIAL**

**TREATMENTS**

<table>
<thead>
<tr>
<th>Treat.</th>
<th>Application</th>
<th>Days After Plant</th>
<th>Product</th>
<th>Rate</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preplant</td>
<td>-9</td>
<td>LOS+P</td>
<td>4.3 m3/ha</td>
<td>206</td>
<td>18</td>
<td>114</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>At Plant</td>
<td></td>
<td>Nil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Top Dress</td>
<td></td>
<td>Nil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>206 18 114 17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Preplant</td>
<td></td>
<td>Nil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>At Plant</td>
<td>0</td>
<td>DAP</td>
<td>180 kg/ha</td>
<td>32</td>
<td>36</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Top Dress</td>
<td>38</td>
<td>NKS Blend</td>
<td>550 kg/ha</td>
<td>149</td>
<td>0</td>
<td>91</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>182 36 91 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Preplant</td>
<td></td>
<td>Nil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>At Plant</td>
<td>0</td>
<td>DAP</td>
<td>180 kg/ha</td>
<td>32</td>
<td>36</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Top Dress</td>
<td>38</td>
<td>LOS</td>
<td>3m3/ha</td>
<td>161</td>
<td>0</td>
<td>91</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>193 36 91 17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NUTRIENT UPTAKE (90 DAP)

90 Days after Planting

N (%) P (%) K (%)

Critical Value
LOSP DAP+KNS DAP+LOS

NUTRIENT UPTAKE (120DAP)

120 Days After Planting

N (%) P (%) K (%)

Critical Value
LOSP DAP+KNS DAP+LOS
PLANT POPULATIONS

Plant Populations - Bugeja

Crop yield

Crop yield

Crop yield (t/ha)

Commercial harvest

LOS+P
DAP+KNS
DAP+LOS

LOS+P
DAP+KNS
DAP+LOS
PRE-PLANT NUTRIENT APPLICATION TRIAL - DISCUSSION

- Fertiliser box no longer needed on planter
- No longer need to spend time loading fertiliser during planting
- Less equipment needed in the paddock at planting
- Less men needed at planting
- Less pressure during the crush – no need to be top dressing
- Provides work for Dunder contractors in quite period before the crush – keep our contractors viable
- Yields not impacted
- Marked out with GPS so liquid fertilisers went exactly where we planted
- Need to be careful that the planter does not push fertiliser into the inter-space
- Cultivate with grubber and roller immediately after application to avoid losses and reduce runoff potential.
SOYBEAN VARIETY TRIAL

HAND HARVEST RESULTS

Variety | Average seeds/kg | Ave plant height at harvest (mm) | Flower initiation (DAP)
--------|------------------|---------------------------------|---------------------
Bunya   | 4,133            | 300                             | 42                  
DN2-11  | 5,205            | 300                             | 42                  
Leichhardt | 7,107          | 800                             | 61                  
ManPKN  | 5,940            | 300                             | 42                  
Stuart  | 6,373            | 700                             | 52                  

SOYBEAN VARIETY TRIAL - DISCUSSION

Southern bred varieties (January plant):
- Some quality advantages
- No yield advantages
- Harvest plant height problems

Tropical varieties (Stuart and Leichhardt):
- More biomass (organic matter- *soil health*"
- Well adapted
- Stuart (white hilum) edible market
- Mid December plant – higher yield potential
COST/BENEFIT ANALYSIS

Costs
(As detailed by the growers, labour costed $200.00/day)

<table>
<thead>
<tr>
<th>Equipment / Modification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extension on harvester elevator to service both 1.5m &amp; 1.8m row spacings</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>Purchase of 1 GPS Unit and steering set-up on tractor</td>
<td>$35,000.00</td>
</tr>
<tr>
<td>Steering set of on a second tractor (unit can be swapped over)</td>
<td>$9,000.00</td>
</tr>
<tr>
<td>Widen out cut-away unit (1.5 days work using scrap in shed)</td>
<td>$300.00</td>
</tr>
<tr>
<td>Widen out tractors – involves turning around the dishes in the wheels and moving the front axle out (3hr/tractor, 5 tractors)</td>
<td>$300.00</td>
</tr>
<tr>
<td>Modified Variable Rate planter</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>– planting rate monitor</td>
<td></td>
</tr>
<tr>
<td>– Extend gooseneck and widen the shoot to 460mm</td>
<td>$12,000.00</td>
</tr>
<tr>
<td>– Various bits &amp; pieces and labour to pull it all together and complete</td>
<td>$7,000.00</td>
</tr>
<tr>
<td>Extension of boom spray</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>TOTAL COST</td>
<td>$72,600.00</td>
</tr>
</tbody>
</table>

Note: the variable rate controller for the planter, and the gooseneck for the planter were optional choices, and are not absolutely required when converting to controlled traffic.

Benefits
(As detailed by the growers, labour costed $200.00/day)

<table>
<thead>
<tr>
<th>Benefit/Saving/Change</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced Planting costs</td>
<td></td>
</tr>
<tr>
<td>- Reduced plant material used with variable rate planter. Reduced planting rate from 10T/ha to 5T/ha. Plant 65Ha each year @ 5t/ha = reduced plant material of 325T @ $30/t =</td>
<td>$9,750.00/year</td>
</tr>
<tr>
<td>- Reduced wear on planter as they plant 17% less rows on 1.8m system compared to 1.5m system. On a 65Ha plant that equals 71.5km of row meters they no longer travel. Assuming $320.00/Ha planting cost, the annual saving of 17% =</td>
<td>$3,536.00/year</td>
</tr>
<tr>
<td>- Labour saving at planting. With pre-plant fertiliser applied by contractors, they no longer need fertiliser and loader in the paddock at planting. Labour saving 5hrs per day for 1 month =</td>
<td>$2,000.00/year</td>
</tr>
<tr>
<td>Spraying Herbicide</td>
<td></td>
</tr>
<tr>
<td>Travel 17% less row metres. On a 460Ha farm that equals 506km of row meters they no longer travel. Assuming fuel use of 30L/Hr and a spray speed of 8km/hr, that equals 63.25hrs of travel saved. 63.2hrs of labour = 63.2hrs tractor use @ 30L diesel/Hr = 1,896 L of fuel @ $1.70/L =</td>
<td>$1,260.00/year</td>
</tr>
<tr>
<td>Harvesting</td>
<td></td>
</tr>
<tr>
<td>- Less cane to be harvested for planting – due to lower planting rate. On a 65Ha plant, with 5T/ha saved, 325T of cane doesn’t need to be harvested/planted. Assuming $8/T to harvest. 325t x $8/T =</td>
<td>$2,600.00/year</td>
</tr>
<tr>
<td>- Time saving at turning on each row. By going to 1.8m rows, the farm now has 488 less drill than when it was under a 1.5m system. Trials within the group have estimated turning costs for each drill at $12.00/drill ($6 per end) - including fuel &amp; labour time. 488 x $12/drill =</td>
<td>$5,856.00/year</td>
</tr>
</tbody>
</table>
Throughput in harvester has increased by 17% even with operating speed reduced by 1.5km/hr - Based on GPS data collect from harvesters by Mackay Sugar. The average harvesting group that operates in 1.8m row spacings has reduced its operating time by 1hr/day (Mackay Sugar data, collected using GPS unit on harvesters) The Bugeja’s 36,000T harvest is considered average and they harvest on a 6 out of 8 roster. Therefore, in a season of 150days, they harvest for 112 days and save 1hr per day. Assuming $400.00/hr to operate the harvester they save 112 hrs per season in the harvester, saving 112 x $400/hr = $44,800.00/year

TOTAL SAVING $73,025.00 Per year

Savings/benefits/changes not valued

- Less wear on harvester (tracks operating on flat ground rather than wearing on one side, less operational hrs per year)
- Less wear on planter
- Less wear on spray rig
- Expected improved water infiltration and holding capacity
- Expected improved soil health
- Ability to move to zonal tillage once 1st cycle is completed
- More time for other activities

COST BENEFIT ANALYSIS - DISCUSSION

- Individuals may debate certain values and costs used. These figures are based on research conducted in the central region by Mackay Sugar, Homebush Innovative Farmers, SRDC, DPI & F, BSES, CSR Ethanol, and grower observations/record keeping.
- The costs associated with the “changeover” to controlled traffic are one-off costs. The benefits/savings made are annual returns.
- The figures used in the “Benefits/savings” column assume the whole 460Ha farm is under controlled traffic – this is not the case, there are still some 1.5m old ratoons yet to be re-planted at 1.8m.
- Based on these figures, the cost of conversion will be paid back (by reduced production costs) after 3 years from first planting of 1.8m (based on a 20% plant each year)
- These figures represent a $2.00 per tonne saving on cost of production. For those that dispute these figures, lets apply a 50% error margin, in which case these figures represent a $1.00 per tonne saving on cost of production.

Intellectual Property and Confidentiality:
(If there is any protected Project Technology, eg information that has been kept confidential, such as equipment specifications, patentable knowledge please outline. Is there anything in this report that should be treated as confidential, and if so under what circumstances?)
NA
Capacity Building:
(How has the Group’s capacity to conduct R&D and implement better farming systems been enhance?)

The group members assisted with the design and monitoring of the trials and consequently have a greater understanding of the importance and issues relating to agronomic research. This is being applied with a more complex trial in their next project.
The members have further developed their ability to function as a group, make key decisions, share resources.
The members have increased their understanding and ability with regards to conducting SRDC funded projects.
The members have increased their skills in communication of project outcomes.
The members (and other growers exposed to the project outcomes) have increased their skill, knowledge and understanding with regard to converting to “New Farming Systems”, and as a result (combined with other influences) have consequently made that conversion

Outcomes:
(What benefits have been achieved or are expected from the project, and what more has to happen to get the full benefit from the project? How do the expected benefits compare with those predicted at the start of the project, as outlined in the Application?)

This project has tested and confirmed that there is a number of cost saving options with the conversion to “New Farming Systems”. The planting systems trialled in this project offer significant time and cost saving. The cost/benefit analysis has documented the benefits and saving as experienced by the grower’s utilising a range of new technologies and practices. The pre-plant nutrient application trial has also shown that significant time and costs can be reduced in this area. Additionally, this project has highlighted the most suitable soybean varieties to utilise in that system.

Environmental Impact:
(Outline any adverse or beneficial environmental impacts of conducting the Project and/or implementing its findings)

The outcomes from this project support the adoption of controlled traffic, reduced tillage, legume break cropping, which are practices that deliver improved resource management.

Communication and Adoption of Outputs:
(Outline any communication activities that have been conducted and any that are planned. How has SRDC been acknowledged or involved? Have any lessons from the project been applied by members of the Group, or others?)

Numerous filed days and farm walks have been conducted by this group. They include, but are not limited to: GIVE 2008 field inspections, LANDCARE conference, GIVE 2008 presentation, BSES New Farming Systems Field Tour, numerous BSES shed meetings.

Recommendations:
(What recommendations would you make as a result of the project, including suggestions for further research and development?)

The issues and concepts investigated in this project have confirmed time and cost saving options for growers. The promotion of these practices should continue, as should localised trials.

Publications:
(List and attach copies (electronically if possible) of all articles, newsletters and other publications from the project.)
The cost/benefit analysis plus a discussion was printed in the BSES Bulletin.